

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: PENN, Laurence Richard

SERIAL NO.: 10/733,163

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TITLE: METERING DEVICE



ART UNIT: 3745

EXAMINER: Lazo, T.E.

AMENDMENT "A"

Amendment A: CLAIM AMENDMENTS

Please cancel Claims 1 - 23 and substitute Claims 24 - 36 therefor as follows:

Claims 1 - 23 (canceled).

24. (new) A metering apparatus comprising:

an elongate chamber;

a shuttle contained in said chamber, said shuttle having a portion fit with a substantially sealing sliding relationship within said chamber, said shuttle being movable axially between a first position at one end of said chamber and a second position at an opposite end of said chamber, each end of said chamber defining a fluid flow means for allowing fluid to enter and exit said chamber;

a valving means for controlling a flow of fluid to and from said chamber such that fluid is supplied to said one end of said chamber causing said shuttle to move from said first position to said second position so as to eject a predetermined volume of fluid from said chamber and subsequently the fluid is supplied to said opposite end of said chamber so as to cause said shuttle to move back from said second position to said first position so as to eject another predetermined quantity of the fluid from said chamber, said valving means comprising:

a spool valve having a spool slidably received within a bore;

a driving means cooperative with said spool for driving said spool between two positions in response to said shuttle reaching either said first position or said second position, said spool in one of said two positions creating a fluid flow path for pressurized liquid from a fluid flow inlet duct to said fluid flow means at one end of said chamber and for creating a fluid flow path from said fluid flow means at the other end of said chamber to a fluid flow outlet duct, said spool in the other of said two positions creating a fluid flow path for pressurized liquid from said fluid flow inlet duct to said fluid flow means at said other end of said chamber and creating a fluid flow path from said fluid flow means at said other end of said chamber to said fluid flow outlet duct, said driving means being a motor arrangement that is controlled by a control unit in response to a signal generated in response to said shuttle reaching either said first position or said second position.

25. (new) The apparatus of Claim 24, wherein said shuttle has two shuttle rods, each of said two shuttle rods extending beyond said chamber, each of said two shuttle rods having a respective movement limiting member adjacent thereto, the rod and the respective movement limiting member establishing contact when said shuttle reaches said first position and said second position so as to generate said signal, at least one of said movement limiting members being adjustably positioned.

26. (new) The apparatus of Claim 25, wherein each movement limiting member is electrically conductive, said shuttle and the shuttle rods are electrically conductive and a chamber contained in the shuttle is electrically conductive, an electric circuit associated with the control unit being completed when the shuttle rod contacts the movement limiting member.

27. (new) The apparatus of Claim 24, wherein said spool of said spool valve comprises four spaced apart sections, each of said sections is in a sealing sliding fit within said bore, said four sections being interconnected by three relatively narrow necks, said fluid flow inlet always being in communication with a space surrounding a central narrow neck of said narrow necks when said spool is being moved between the two positions, a respective part of the fluid flow outlet duct always being in communication with the spaces surrounding each of the other two necks, a plurality of flow ports being located at spaced locations along an axis of said bore, the plurality of flow ports being positioned such that in one position of said spool one of said plurality of flow ports that is in communication with the flow means at one end of the chamber containing said shuttle is open to permit flow from the region surrounding the central narrow neck and another of said plurality of flow ports that is in communication with the fluid flow means at the other end of the chamber is open to permit fluid flow to the space surrounding one of the outer narrow necks, and in the other position of said spool the fluid flow port that is in communication with the other end of said chamber is open to permit fluid flow from the region surrounding the central narrow neck, and the fluid flow port that is in communication with the fluid flow means at said one end of the chamber is open to permit fluid flow to the space surrounding the other of said outer narrow necks.

28. (new) The apparatus of Claim 24, further comprising:

a valve connected to said outlet flow duct, said valve being positionable to direct the flow of fluid from said outlet flow duct to one of the plurality of discharge ports.

29. (new) The apparatus of Claim 28, wherein one of said plurality of discharge ports is a main discharge port and another of said plurality of discharge ports is a leakage test port.

30. (new) The apparatus of Claim 29, wherein another of said plurality of discharge ports is a sampling port.

31. (new) The apparatus of Claim 28, wherein said valve comprises a cylindrical valve member slidably mounted within a cylindrical bore so as to execute a predetermined axial movement, said valve member having a central portion of a first diameter which is in a substantially sealing sliding fit within said bore, said valve having two axially extending valve rods of lesser diameter which pass through respective seals at opposed ends of said bore, said valve member having a chamber defined therein, said central chamber and the exterior of the valve member having fluid flow ports communicating therewith respectively on each of said valve rods and on the control cylindrical portion, a space surrounding each of said valve rods being in fluid flow communication regardless of the position of said valve member with said fluid flow outlet duct, said valve member having an outlet formed in said cylindrical portion thereof adapted to be aligned with each one of said plurality of discharge ports.

32. (new) The apparatus of Claim 24, wherein said spool valve has a first fluid inlet and a first fluid outlet and said fluid flow means extending to one end of said chamber and located adjacent one end of said bore, said spool valve has a second fluid inlet and a second fluid outlet and said fluid flow means extending to the other end of said chamber and located adjacent to the other end of said bore, said spool having a central region that is in a sliding sealing fit within said bore, said spool having a relatively narrow diameter neck at each end thereof so that said spool connects said first fluid inlet to said fluid flow path extending to said one end of said chamber and connects said second fluid inlet to said fluid flow path extending to said other end of said chamber in said one position, and connects said second fluid inlet to said fluid flow path extending to said other end of

said chamber and connects said first fluid outlet to said fluid flow path extending to said one end of said chamber in said other position.

33. (new) The apparatus of Claim 32, wherein portion of said chamber intermediate the ends thereof defines a cavity surrounding part of said shuttle and adapted to receive a flow of a solvent.

34. (new) The apparatus of Claim 32, wherein part of said bore of said spool valve intermediate the ends thereof defines a cavity surrounding part of said spool and adapted to receive a flow of a solvent.

35. (new) The apparatus of Claim 32, wherein a volume within said chamber that communicates with said flow means at said one end of said chamber when said shuttle is at said other end of the chamber is greater than a volume within said chamber that communicates with said fluid flow means at said other end of said chamber when said shuttle is at said one end of said chamber.

36. (new) The apparatus of Claim 24, wherein said shuttle has two shuttle rods of different diameter, each of said two shuttle rods extending from a respective end of a central part of said shuttle to an exterior of said chamber.